U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-285 683

Lake Marion
Polk County, Florida

National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

Dec 77

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO. PB285683
4. TITLE AND SUBTITLE: Report On Lake Marion, Polk County, Florida		5. REPORT DATE: Prepared December 1977 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S): Anonymous (National Eutrophication Survey Staff)		8. PERFORMING ORGANIZATION REPORT NO.: Working Paper # 264
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Pacific Northwest Environmental Research Laboratory U.S. Environmental Protection Agency 200 S. W. 35th St. Corvallis, Oregon 97330		10. PROGRAM ELEMENT NO.: 1BA029 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS: Office of Research and Development U.S. Environmental Protection Agency 401 M Street, S. W. Washington, DC 20460		13. TYPE OF REPORT AND PERIOD COVERED: Final 1973 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES
Prepared in cooperation with the U.S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, Nevada 89114

16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading	National Eutrophication Survey Lake Survey	05B 05C

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report)	21. NO. OF PAGES
Release Unlimited	Unclassified	42
	20. SECURITY CLASS (This page)	22. PRICE PCA03 MFA01

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

PB 285 683

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

REPORT
ON
LAKE MARION
POLK COUNTY
FLORIDA
EPA REGION IV
WORKING PAPER No. 264

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON
and
ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

O. 699-440

REPORT
ON
LAKE MARION
POLK COUNTY
FLORIDA
EPA REGION IV
WORKING PAPER No. 264

WITH THE COOPERATION OF THE

FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION

AND THE

FLORIDA NATIONAL GUARD

DECEMBER, 1977

CONTENTS

	Page
Foreword	ii
List of Florida Lakes	iv
Lake and Drainage Area Map	v
Sections	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	4
III. Lake Water Quality Summary	5
IV. Nutrient Loadings	9
V. Literature Reviewed	13
VI. Appendices	14

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Florida Department of Environmental Regulation for professional involvement and to the Florida National Guard for conducting the tributary sampling phase of the Survey.

Joseph W. Landers, Jr., Secretary of the Department of Environmental Regulation; John A Redmond, former Director of the Division of Planning, Technical Assistance, and Grants; and Dr. Tim S. Stuart, Chief of the Bureau of Water Quality, provided invaluable lake documentation and counsel during the survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

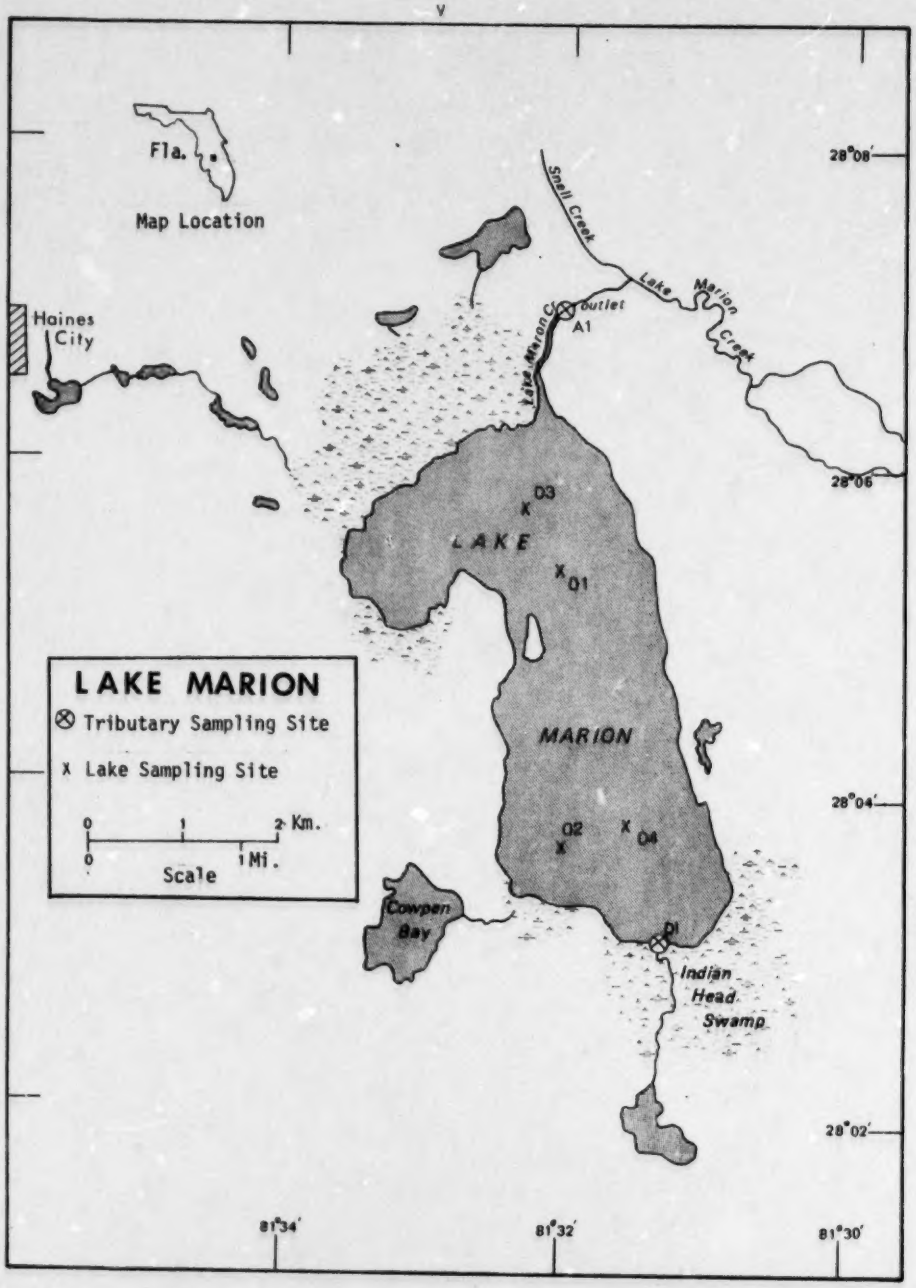
Major General Henry W. McMillan (Retired), then the Adjutant General of Florida, and Project Officer Colonel Hugo F. Windham, who directed the volunteer efforts of the Florida National Guard, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF FLORIDA

LAKE NAME	COUNTY
Alligator	Columbia
Apopka	Lake, Orange
Banana	Polk
Crescent	Flagler, Putnam
Doctors	Clay
Dora	Lake
East Tohopekaliga	Osceola
Effie	Polk
Eloise	Polk
George	Putnam, Volusia
Gibson	Polk
Glenada	Highlands
Griffin	Lake
Haines	Polk
Hancock	Polk
Horseshoe	Seminole
Howell	Orange, Seminole
Istokpoga	Highlands
Jessie	Polk
Jessup	Seminole
Kissimmee	Osceola
Lawne	Orange
Lulu	Polk
Marion	Polk
Minnehaha	Orange
Minneola	Lake
Monroe	Seminole, Volusia
Munson	Leon
Okeechobee	Glades, Hendry, Martin, Okeechobee, Palm Beach
Poinsett	Brevard, Orange, Osceola
Reedy	Polk
Seminole	Jackson, FL; Decatur, Seminole, GA
Seminole	Pinellas
South	Brevard
Talquin	Gadsden, Leon
Tarpon	Pinellas
Thonotosassa	Hillsborough
Tohopekaliga	Osceola
Trout	Lake
Weohyakapka	Polk
Yale	Lake


Fla.
Map Location
Haines City
Snell Creek
Lake Marion Creek
Outlet
A1
Lake Marion Creek
28°08'
28°06'
28°04'
28°02'
81°34'
81°32'
81°30'
LAKE
MARION
03
01
02
04
D1
Cowpen Bay
Indian Head Swamp
LAKE MARION
Tributary Sampling Site
Lake Sampling Site
0 1 2 Km.
0 1 Mi.
Scale

LAKE MARION

STORET NO. 1228

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Lake Marion is eutrophic. It ranked fourteenth in overall trophic quality when the 41 Florida lakes sampled in 1973 were compared using a combination of six parameters*. Nine of the lakes had less median total phosphorus, 11 had less median dissolved phosphorus, 27 had less and three had the same median inorganic nitrogen, 20 had less mean chlorophyll a, and 18 had greater mean Secchi disc transparency.

Survey limnologists noted emergent aquatic vegetation along much of the shoreline. The numbers of blue-green algae in the phytoplankton samples (see page 7) further indicate the eutrophic condition of the lake.

B. Rate-Limiting Nutrient:

The results of the algal assay indicate Lake Marion was phosphorus limited at the time the sample was collected (03/13/73). High inorganic nitrogen to orthophosphorus ratios in the lake at that time substantiate this finding. However, the mean inorganic nitrogen/orthophosphorus ratios in September indicate phosphorus limitation at station 4 but nitrogen limitation at station 3, and the November data indicate nitrogen limitation at both sampling stations.

---

* See Appendix A.

C. Nutrient Controllability:

1. Point sources--No known municipal or industrial point sources impacted Lake Marion during the sampling year. Septic tanks serving shoreline dwellings were estimated to have contributed 1.1% of the total phosphorus load, but a shoreline survey would be necessary to determine the significance of these sources.

Prior to 1971, the lake received the effluent of an activated sludge wastewater treatment plant serving Haines City (the 1970 population was 8,956). However, in 1971 this plant was replaced with a contact stabilization plant equipped with an effluent storage pond; and since then, percolation and evaporation from the pond have eliminated discharges to Lake Marion (Drummond, 1971).

The present phosphorus loading of 0.15 $g/m^2/yr$ is slightly in excess of that proposed by Vollenweider (Vollenweider and Dillon, 1974) as an oligotrophic loading (see page 12). The existing trophic condition of the lake probably is due to the much higher phosphorus loading prior to 1971 and subsequent recycling of phosphorus from bottom deposits (Stuart, 1976).

Significant improvement in the trophic condition of the lake should occur if the existing loading is maintained.

2. Non-point sources--It is estimated that non-point sources,

including precipitation, contributed 98.9% of the total phosphorus inputs to Lake Marion. The largest contribution was from the minor tributaries and immediate drainage, which accounted for an estimated 61.5% of the phosphorus load. The 1970 U.S.G.S. Dundee quadrangle map indicates that land use around the lake is predominantly agricultural.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 12.82 kilometers^2.
2. Mean depth: 1.3 meters.
3. Maximum depth: 3.0 meters.
4. Volume: 16.666 x 10^6 m^3.
5. Mean hydraulic retention time: 235 days.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Unnamed Creek D-1	8.1	0.08
Minor tributaries & immediate drainage -	71.6	0.74
Totals	79.7	0.82

2. Outlet -

Lake Marion Creek	92.5**	0.82

C. Precipitation***:

1. Year of sampling: 112.8 centimeters.
2. Mean annual: 134.1 centimeters.

---

† Table of metric conversions--Appendix B.
†† No bathymetric map available. Surface area from FL Dept. of Env. Reg.; depths estimated from soundings reported in Appendix D.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Lake Marion was sampled three times in 1973 by means of a pontoon-equipped Huey helicopter. The first time, surface samples for physical and chemical parameters were collected from stations 1 and 2 and the second and third times from stations 3 and 4 (see map, page v). During each visit, a single depth-integrated (near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, a single 18.9-liter depth-integrated sample was composited from stations 1 and 2 for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 1.8 meters at station 1, near-surface only at station 2, and 0.3 meters at stations 3 and 4.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR LAKE MARION
STORET CODE 1228

	1ST SAMPLING (3/13/73) 2 SITES			2ND SAMPLING (9/ 6/73) 2 SITES			3RD SAMPLING (11/ 7/73) 2 SITES		
PARAMETER	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN
TEMP (C)	25.5 - 27.2	26.4	26.6	28.5 - 28.7	28.6	28.6	23.7 - 24.3	24.0	24.0
DISS OXY (MG/L)	9.6 - 10.4	10.0	10.0	7.4 - 7.4	7.4	7.4	8.8 - 9.0	8.9	8.9
CNDCTVY (MCROMO)	135. - 140.	137.	135.	131. - 131.	131.	131.	114. - 116.	115.	115.
PH (STAND UNITS)	8.9 - 9.2	9.1	9.1	8.5 - 8.6	8.5	8.5	8.8 - 8.9	8.8	8.8
TOT ALK (MG/L)	36. - 38.	37.	38.	33. - 33.	33.	33.	34. - 34.	34.	34.
TOT P (MG/L)	0.042 - 0.057	0.048	0.044	0.035 - 0.037	0.036	0.036	0.054 - 0.067	0.060	0.060
ORTHO P (MG/L)	0.008 - 0.011	0.009	0.008	0.016 - 0.023	0.019	0.019	0.029 - 0.039	0.034	0.034
NO2+NO3 (MG/L)	0.160 - 0.170	0.167	0.170	0.130 - 0.150	0.140	0.140	0.120 - 0.120	0.120	0.120
AMMONIA (MG/L)	0.160 - 0.170	0.167	0.170	0.110 - 0.110	0.110	0.110	0.100 - 0.100	0.100	0.100
KJEL N (MG/L)	1.400 - 1.800	1.567	1.500	2.500 - 2.600	2.550	2.550	2.100 - 2.200	2.150	2.150
INORG N (MG/L)	0.320 - 0.340	0.333	0.340	0.240 - 0.260	0.250	0.250	0.220 - 0.220	0.220	0.220
TOTAL N (MG/L)	1.570 - 1.970	1.733	1.660	2.630 - 2.750	2.690	2.690	2.220 - 2.320	2.270	2.270
CHLRPYL A (UG/L)	25.8 - 31.2	28.5	28.5	27.0 - 40.9	33.9	33.9	27.2 - 27.7	27.4	27.4
SECCHI (METERS)	0.6 - 0.8	0.7	0.7	0.9 - 0.9	0.9	0.9	0.7 - 0.8	0.8	0.8

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal units per ml
03/13/73	1. Lyngbya sp.	44,209
	2. Anabaenopsis sp.	30,544
	3. Dactylococcopsis sp.	16,679
	4. Aphanothece sp.	8,239
	5. Nitzschia sp.	3,617
	Other genera	8,238
	Total	111,526
09/06/73	1. Lyngbya sp.	93,556
	2. Blue-green filaments	25,795
	3. Anabaena sp.	5,198
	4. Achnanthes sp.	2,695
	5. Aphanothece sp.	1,733
	Other genera	9,431
	Total	138,408
11/07/73	1. Lyngbya sp.	111,650
	2. Blue-green filaments	39,078
	3. Anabaena sp.	5,518
	4. Achnanthes sp.	5,198
	5. Cosmarium sp.	4,813
	Other genera	9,245
	Total	175,502

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
03/13/73	1	31.2
	2	25.8
	3	-
	4	-
09/06/73	1	-
	2	-
	3	27.0
	4	40.9
11/07/73	1	-
	2	-
	3	27.7
	4	27.2

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.028	0.156	3.3
0.050 P	0.078	0.156	7.7
0.050 P + 1.0 N	0.078	1.156	17.4
1.0 N	0.028	1.156	3.4

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Lake Marion was moderately high at the time the sample was collected (03/13/73). Also, increased yields with increased concentrations of orthophosphorus indicate that the lake was limited by phosphorus at that time (note that the addition of nitrogen alone resulted in a yield not significantly greater than the control yield).

The lake data show a temporal and spatial combination of limiting nutrients. Following is a tabulation of the mean inorganic nitrogen/orthophosphorus ratios for each of the stations and sampling times with the indicated limiting nutrient in parentheses.

Station	03/13/73	09/06/73	11/07/73
1	36/1 (P)	-	-
2	20/1 (P)	-	-
3	-	10/1 (N)	8/1 (N)
4	-	16/1 (P)	6/1 (N)

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Florida National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v). Sampling was begun in March, 1973, and was completed in February, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Florida District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads, in $kg/km^2/yr$, at station D-1 and multiplying by the ZZ area in km^2.

No known wastewater treatment plants impacted Lake Marion during the sampling year.

---

* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal - None

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed Creek D-1	130	7.0
b. Minor tributaries & immediate drainage (non-point load) -	1,145	61.5
c. Known municipal STP's - None	-	-
d. Septic tanks* -	20	1.1
e. Known industrial - None	-	-
f. Direct precipitation** -	565	30.4
Total	1,860	100.0

2. Outputs -

Lake outlet - Lake Marion Creek 1,065

3. Net annual P accumulation - 795 kg.

* Estimate based on 74 lakeshore dwellings; see Working Paper No. 175.
** Brezonik and Shannon, 1971.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Unnamed Creek D-1	5,625	8.9
b. Minor tributaries & immediate drainage (non-point load) -	49,690	78.2
c. Known municipal STP's - None	-	-
d. Septic tanks* -	790	1.2
e. Known industrial - None	-	-
f. Direct precipitation** -	7,435	11.7
Total	63,540	100.0

2. Outputs -

Lake outlet - Lake Marion Creek 54,375

3. Net annual N accumulation - 9,165 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Unnamed Creek D-1	16	694

* Estimate based on 74 lakeshore dwellings; see Working Paper No. 175.
** Brezonik and Shannon, 1971.

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Note, however, that Florida lakes may be able to assimilate phosphorus at a somewhat higher level than that suggested by Vollenweider (Shannon and Brezonik, 1972).

Essentially, Vollenweider's "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	0.15	0.06	5.0	0.7

Vollenweider phosphorus loadings ($g/m^2/yr$) based on estimated mean depth and hydraulic retention time of Lake Marion:

"Dangerous" (eutrophic loading)	0.28
"Permissible" (oligotrophic loading)	0.14

V. LITERATURE REVIEWED

Brezonik, Patrick L., and Earl E. Shannon, 1971. The trophic state of lakes in north central Florida. Publ. No. 13, Water Resources Res. Ctr., U. of FL, Gainesville.

Drummond, William (Director), 1975. Personal communication (past and present Haines City wastewater treatment systems). Community Development Dept., Haines City.

Shannon, Earl E., and Patrick L. Brezonik, 1972. Relationships between lake trophic state and nitrogen and phosphorus loading rates. Env. Sci. & Techn. 6 (8): 719-725.

Stuart, Tim A., 1976. Personal communication (review of preliminary report). FL Dept. of Env. Reg., Tallahassee.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLOPA	15-MIN DO	MEDIAN DISS ORTHO P
1201	ALLIGATOR LAKE	0.620	0.260	474.000	87.733	13.100	0.386
1202	LAKE APOPKA	0.102	0.230	484.176	46.611	8.200	0.019
1203	LAKE BANANA	0.660	0.260	482.667	208.600	3.600	0.293
1206	LAKE CRESCENT	0.065	0.130	473.884	10.211	10.200	0.033
1207	DOCTORS LAKE	0.084	0.120	465.555	27.100	10.600	0.028
1208	LAKE DORA	0.102	0.240	482.889	54.978	7.400	0.022
1209	LAKE EFFIE	1.480	0.410	489.000	261.433	15.000	0.950
1210	LAKE GEORGE	0.129	0.165	469.308	35.000	11.000	0.063
1211	LAKE GIBSON	0.167	0.115	470.000	19.675	10.200	0.069
1212	GLENADA LAKE	0.134	0.165	454.167	27.667	14.700	0.072
1214	LAKE GRIFFIN	0.119	0.260	481.333	66.855	6.600	0.038
1215	LAKE HAINES	0.063	0.115	462.667	26.567	10.600	0.014
1217	LAKE HANCOCK	0.772	0.195	483.500	97.900	5.600	0.158
1219	LAKE HORSESHOE	0.034	0.130	459.000	12.067	11.500	0.023
1220	LAKE HOWELL	1.260	0.285	464.000	54.117	9.000	1.175
1221	LAKE ISTOKPOGA	0.039	0.120	464.222	6.594	8.600	0.010
1223	LAKE JESSUP	0.492	0.290	487.000	76.550	7.600	0.288
1224	LAKE KISSIMMEE	0.034	0.145	463.667	24.142	8.800	0.007
1227	LAKE LILU	1.490	1.065	483.000	276.566	14.300	1.030
1228	LAKE MARION	0.044	0.260	468.833	29.967	7.600	0.016
1229	LAKE MINNEHAHA	0.038	0.080	435.000	8.733	7.700	0.012
1230	LAKE MINNEOLA	0.018	0.070	406.333	3.333	7.400	0.009
1231	LAKE MONROE	0.188	0.300	474.555	14.225	10.800	0.128
1232	LAKE OKEECHOBEE	0.063	0.185	472.366	14.524	9.800	0.010
1234	LAKE POINSETT	0.085	0.150	469.000	6.500	10.600	0.051
1236	LAKE PEEDY	0.033	0.330	468.500	34.837	10.600	0.008
1238	LAKE SOUTH	0.074	0.130	464.000	23.167	9.000	0.028
1239	LAKE TALQUIN	0.085	0.290	462.167	9.483	14.400	0.031

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
1240	LAKE THONOTOSASSA	0.695	0.095	466.167	37.700	10.200	0.565
1241	LAKE TOHOPEKALIGA	0.246	0.200	472.917	30.633	10.500	0.152
1242	TROUT LAKE	1.110	0.650	472.000	76.967	12.900	0.970
1243	LAKE WEOHYAKAPKA	0.047	0.080	458.667	7.767	8.200	0.011
1246	LAKE YALE	0.027	0.160	441.000	25.367	7.600	0.014
1247	LAKE MUNSON	1.475	0.925	486.667	140.317	12.200	0.852
1248	LAKE SEMINOLE	0.234	0.175	473.833	102.000	8.600	0.026
1249	LAKE LAWNE	2.560	1.350	494.667	84.900	10.400	0.117
1250	LAKE TARPON	0.041	0.070	400.889	6.867	9.000	0.027
1252	LAKE ELOISE	0.486	0.170	465.333	70.233	12.200	0.339
1256	LAKE JESSIE	0.051	0.090	452.667	26.300	10.800	0.011
1261	EAST LAKE TOHOPEKALIGA	0.042	0.070	440.833	5.167	9.400	0.007
1264	PAYNE'S PRAIRIE LAKE (NO	1.260	0.140	476.000	88.200	7.400	1.210

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
1201	ALLIGATOR LAKE	25 (10)	29 (10)	30 (12)	18 (7)	10 (4)	18 (7)	130
1202	LAKE APOPKA	50 (20)	38 (15)	10 (4)	38 (15)	74 (29)	70 (28)	280
1203	LAKE BANANA	23 (9)	29 (10)	20 (8)	5 (2)	100 (40)	23 (9)	200
1206	LAKE CRESCENT	65 (26)	70 (27)	33 (13)	80 (32)	48 (18)	50 (20)	346
1207	DOCTORS LAKE	60 (24)	76 (30)	60 (24)	55 (22)	34 (12)	56 (22)	341
1208	LAKE DORA	53 (21)	35 (14)	18 (7)	33 (13)	90 (35)	68 (27)	297
1209	LAKE EFFIE	5 (2)	10 (4)	3 (1)	3 (1)	0 (0)	10 (4)	31
1210	LAKE GEORGE	45 (18)	54 (21)	48 (19)	43 (17)	23 (9)	43 (17)	256
1211	LAKE GIBSON	40 (16)	81 (32)	45 (18)	70 (28)	48 (18)	40 (16)	324
1212	GLENADA LAKE	43 (17)	54 (21)	85 (34)	53 (21)	3 (1)	38 (15)	276
1214	LAKE GRIFFIN	48 (19)	29 (10)	23 (9)	30 (12)	95 (38)	48 (19)	273
1215	LAKE HAINES	70 (28)	81 (32)	75 (30)	58 (23)	34 (12)	78 (31)	396
1217	LAKE HANCOCK	18 (7)	43 (17)	13 (5)	13 (5)	98 (39)	28 (11)	213
1219	LAKE HORSESHOE	93 (37)	70 (27)	80 (32)	78 (31)	20 (8)	65 (26)	406
1220	LAKE HOWELL	11 (4)	23 (9)	69 (27)	35 (14)	60 (23)	3 (1)	201
1221	LAKE ISTOKPOGA	85 (34)	76 (30)	65 (26)	93 (37)	69 (27)	89 (35)	477
1223	LAKE JESSUP	28 (11)	18 (7)	5 (2)	25 (10)	83 (32)	25 (10)	184
1224	LAKE KISSIMMEE	90 (36)	63 (25)	73 (29)	65 (26)	65 (26)	99 (39)	455
1227	LAKE LULU	3 (1)	3 (1)	15 (6)	0 (0)	8 (3)	5 (2)	34
1228	LAKE MARION	78 (31)	29 (10)	53 (21)	50 (20)	83 (32)	73 (29)	366
1229	LAKE MINNEHAHA	88 (35)	91 (36)	95 (38)	85 (34)	78 (31)	80 (32)	517
1230	LAKE MINNEOLA	100 (40)	98 (38)	98 (39)	100 (40)	90 (35)	93 (37)	579
1231	LAKE MONROE	38 (15)	15 (6)	28 (11)	75 (30)	26 (10)	33 (13)	215
1232	LAKE OKEECHOBEE	68 (27)	45 (18)	40 (16)	73 (29)	53 (21)	89 (35)	368
1234	LAKE POINSETT	58 (23)	60 (24)	50 (20)	95 (38)	34 (12)	45 (18)	342
1236	LAKE WEEDY	95 (38)	13 (5)	55 (22)	45 (18)	34 (12)	95 (38)	337
1238	LAKE SOUTH	63 (25)	70 (27)	69 (27)	68 (27)	60 (23)	56 (22)	386
1239	LAKE TALQUIN	55 (22)	20 (8)	78 (31)	83 (33)	5 (2)	53 (21)	294

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
1240	LAKE THONOTOSASSA	20 (8)	85 (34)	58 (23)	40 (16)	48 (18)	15 (6)	266
1241	LAKE TOHOPEKALIGA	33 (13)	40 (16)	38 (15)	48 (19)	40 (16)	30 (12)	229
1242	TROUT LAKE	15 (6)	8 (3)	43 (17)	23 (9)	13 (5)	8 (3)	110
1243	LAKE WEOHYAKAPKA	75 (30)	91 (36)	83 (33)	88 (35)	74 (29)	84 (33)	495
1246	LAKE YALE	98 (39)	58 (23)	90 (36)	63 (25)	83 (32)	75 (30)	467
1247	LAKE HUNSON	8 (3)	5 (2)	8 (3)	8 (3)	16 (6)	13 (5)	58
1248	LAKE SEMINOLE	35 (14)	48 (19)	35 (14)	10 (4)	69 (27)	63 (25)	260
1249	LAKE LAWNE	0 (0)	0 (0)	0 (0)	20 (8)	43 (17)	35 (14)	98
1250	LAKE TARPON	83 (33)	98 (38)	100 (40)	90 (36)	60 (23)	60 (24)	491
1252	LAKE ELOISE	30 (12)	50 (20)	63 (25)	28 (11)	16 (6)	20 (8)	207
1258	LAKE JESSIE	73 (29)	88 (35)	88 (35)	60 (24)	26 (10)	84 (33)	419
1261	EAST LAKE TOHOPEKALIGA	80 (32)	98 (38)	93 (37)	98 (39)	55 (22)	99 (39)	523
1264	PAYNE'S PRAIRIE LAKE (NO	11 (4)	65 (26)	25 (10)	15 (6)	98 (35)	0 (0)	206

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	1230	LAKE MINNEOLA	579
2	1261	EAST LAKE TOHOPEKALIGA	523
3	1229	LAKE MINNEHAHA	517
4	1243	LAKE WEOHYAKAPKA	495
5	1250	LAKE TARPON	491
6	1221	LAKE ISTOKPOGA	477
7	1246	LAKE YALE	467
8	1224	LAKE KISSIMMEE	455
9	1258	LAKE JESSIE	419
10	1219	LAKE HORSESHOE	406
11	1215	LAKE HAINES	396
12	1238	LAKE SOUTH	386
13	1232	LAKE OKEECHOBEE	368
14	1228	LAKE MARION	366
15	1206	LAKE CRESCENT	346
16	1234	LAKE POINSETT	342
17	1207	DOCTORS LAKE	341
18	1236	LAKE REEDY	337
19	1211	LAKE GIBSON	324
20	1208	LAKE DORA	297
21	1239	LAKE TALQUIN	294
22	1202	LAKE APOPKA	280
23	1212	GLENADA LAKE	276
24	1214	LAKE GRIFFIN	273
25	1240	LAKE THONOTOSASSA	266
26	1248	LAKE SEMINOLE	260
27	1210	LAKE GEORGE	256
28	1241	LAKE TOHOPEKALIGA	229

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
29	1231	LAKE MONROE	215
30	1217	LAKE HANCOCK	213
31	1252	LAKE ELOISE	207
32	1264	PAYNE'S PRAIRIE LAKE (NO	206
33	1228	LAKE HOWELL	201
34	1203	LAKE YANANA	200
35	1223	LAKE JESSUP	184
36	1201	ALLIGATOR LAKE	130
37	1242	TROUT LAKE	110
38	1249	LAKE LAWNE	98
39	1247	LAKE MUNSON	58
40	1227	LAKE LULU	34
41	1209	LAKE EFFIE	31

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles.

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 · cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR FLORIDA 8/25/75

LAKE CODE 1228 LAKE MARION

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 92.5

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1228A1	92.5	0.76	0.74	0.77	0.70	0.47	0.50	0.76	0.86	1.15	1.31	1.00	0.82	0.82
1228D1	8.1	0.08	0.08	0.08	0.07	0.06	0.08	0.08	0.11	0.10	0.10	0.08	0.07	0.08
1228ZZ	72.3	0.69	0.74	0.74	0.61	0.56	0.72	0.68	0.95	0.88	0.90	0.73	0.65	0.74

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 92.5
SUM OF SUB-DRAINAGE AREAS = 80.3

TOTAL FLOW IN = 9.85
TOTAL FLOW OUT = 9.83

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1228A1	3	73	0.57	17	0.60				
	4	73	0.61	16	0.62				
	5	73	0.44	18	0.47				
	6	73	0.34	16	0.30				
	7	73	0.52	15	0.61				
	8	73	0.65	17	0.63				
	9	73	0.95	16	1.00				
	10	73	0.94	12	1.14				
	11	73	0.71	16	0.70				
	12	73	0.58	13	0.55				
	1	74	0.52	18	0.51				
	2	74	0.41	17	0.40				
1228D1	3	73	0.03	17	0.04				
	4	73	0.05	16	0.00				
	5	73	0.06	18	0.02				
	6	73	0.06	16	0.12				
	7	73	0.02	15	0.31				
	8	73	0.10	17	0.01				
	9	73	0.07	16	0.04				
	10	73	0.06	12	0.08				
	11	73	0.05	16	0.09				
	12	73	0.07	13	0.08				
	1	74	0.06	18	0.08				
	2	74	0.03	17	0.07				
1228ZZ	3	73	0.28	17	0.39				
	4	73	0.45	16	0.03				
	5	73	0.53	18	0.16				
	6	73	0.55	16	1.03				
	7	73	0.14	15	2.89				
	8	73	0.61	17	0.10				
	9	73	0.62	16	0.37				
	10	73	0.52	12	0.69				
	11	73	0.42	16	0.82				
	12	73	0.61	13	0.72				
	1	74	0.55	18	0.69				
	2	74	0.27	17	0.67				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/08/25

122801
28 05 19.0 081 32 05.0
LAKE MARION
12105 FLORIDA

11EPALES
3

2111202
0010 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO26NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/13	17 00	0000	27.2			140	9.20	38	0.170	1.800	0.170	0.008
	17 00	0006	25.5	9.6	24	135	8.90	38	0.170	1.400	0.170	0.011

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/13	17 00	0000	0.044	31.2
	17 00	0006	0.057	

STORET RETRIEVAL DATE 75/08/25

122802
28 03 47.0 081 31 58.0
LAKE MARION
12105 FLORIDA

11EPALES
3

2111202
0005 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/13	17	30 0000	26.6	10.4	30	135	9.10	36	0.160	1.500	0.160	0.008

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/13	17	30 0000	0.042	25.8

STORET RETRIEVAL DATE 75/08/25

122803
28 05 38.0 081 32 23.0
LAKE MARION
12105 FLORIDA

11EPALES
3

2111202
0005 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/09/06	09 20	0000	28.5	7.4	35	131	8.50	33	0.110	2.500	0.130	0.023
73/11/07	13 11	0000	23.7		29	116	8.80	34	0.100	2.100	0.120	0.029
	13 11	0001	23.7	9.0		116						

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/09/06	09 20	0000	0.035	27.0
73/11/07	13 11	0000	0.054	27.7

STORET RETRIEVAL DATE 75/08/25

122804
28 03 52.0 081 31 41.0
LAKE MARION
12105 FLORIDA

11EPALES
3

2111202
0007 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/09/06	09 55	0000	28.7	7.4	36	131	8.60	33	0.110	2.600	0.150	0.016
73/11/07	13 00	0000	24.3		33	114	8.90	34	0.100	2.200	0.120	0.039
	13 00	0001	24.3	8.8		114						

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/09/06	09 55	0000	0.037	40.9
73/11/07	13 00	0000	0.067	27.2

APPENDIX E

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 75/08/25

1228A1
28 07 00.0 081 32 00.0
LAKE MARION CREEK
12105 7.5 DUNDEE
O/LAKE MARION
BRDG .5 MI N OF LAKE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/17	10 45		0.010K	2.940	0.042	0.010	0.060
73/04/16	15 15		0.018	3.800	0.064	0.014	0.065
73/05/18	14 45		0.010K	2.100	0.013	0.016	0.050
73/06/16			0.019	1.600	0.042	0.013	0.040
73/07/15	10 30		0.018	2.300	0.105	0.005K	0.045
73/08/17	15 30		0.017	3.000	0.102	0.013	0.030
73/09/16	08 00		0.013	1.050	0.009	0.011	0.045
73/10/12	16 00		0.015	1.050	0.590	0.019	0.019
73/11/16	11 00		0.036	1.400	0.092	0.016	0.020
73/12/13	10 25		0.010K	2.300	0.100	0.012	0.025
74/01/18	08 45		0.048	1.400	0.032	0.012	0.045
74/02/17	08 30		0.040	1.800	0.035	0.010	0.045

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/08/25

1228D1
28 03 00.0 081 31 30.0
UNNAMED CREEK DRNG INDIAN HD SWM
12 7.5 DUNDEE
T/LAKE MARION
BX BOAT AT MOUTH OF CREEK
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/17	09 45		0.010K	1.800	0.016	0.012	0.065
73/04/16	15 30		0.048	4.700	0.280	0.008	0.047
73/05/18	15 00		0.010K	3.335	0.052	0.009	0.050
73/06/16			0.010K	3.000	0.061	0.011	0.045
73/07/15	14 35		0.010K	0.795	0.019	0.005K	0.040
73/08/17	15 50		0.022	3.900	0.160	0.024	0.030
73/09/16	08 30		0.010K	1.380	0.011	0.014	0.045
73/10/12	16 18		0.010K	1.200	0.033	0.017	0.050
73/11/16	10 30		0.116	0.800	0.020	0.012	0.030
73/12/13	10 05		0.024	1.100	0.108	0.012	0.020
74/01/18	09 40		0.056	1.200	0.064	0.016	0.050
74/02/17	08 00		0.024	2.100	0.015	0.010	0.115

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/08/25

1228CA
28 06 30.0 081 36 30.0
HAINES CITY
12105 7.5 DUNDEE
T/LAKE MARION
UNNAMED TRIB
11EPALES
4

2141204
0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/02/06	10 00		0.820	17.000	8.300	9.500	10.500	1.000	1.000